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PRODUCTION AND USE OF AEROSOLS

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PRODUCTION AND USE OF AEROSOLS

Interview with
PROFESSOR L. DAUTREBANDE IN BRUSSELS

2 December 1944

Report by

DR. GEOFFREY BROUGHTON OSRD
and
DR. E. W. LANFEAR MOS

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SHAEF (BELGIAN) MISSION
December 2, 1944

PRODUCTION AND USE OF AEROSOLS

On December 2, 1944, acting on the instructions of G-3, SHAEF (Colonel N.M.Lack), a visit was made to Professor L. Dautrebande at his home, 184 Chaussee de la Grande Espinette, Rhode St. Geneve, Brussels. Prof. Dautrebande is undoubtedly a toxicologist of standing in Belgium, and has been introduced to SHAEF Belgian Mission by the British Embassy. He states that he is known to the following persons in England: Sir Henry Dale, FRS; Prof. Heilbron, FRS; Prof. Douglas, FRS; Mr. Kingan; Sir Robert Davies and Prof. J.B. Haldane.

The professor disclosed that for some years he had been working on the production of aerosols (suspension of small electrically charged particles in air, size range of the order of 0.1 to 20 μ). These aerosols differ from those normally made in two respects:

- (a) They are more uniform in particle size, i.e. range from largest to smallest diameter is of the order 1-5 μ (one example cited).
- (b) They contain no ordinary, uncharged droplets of atomized liquid. Such aerosols he terms "aerosols vecteurs".

Method of preparation

The principles of the method by which such aerosols are prepared are:

(a) Dispersal of the material in question by impingement of the two ejector jets of compressed air against each other about 1 cm above the surface of its solution.

(b) Filtration out of all sizes of uncharged ordinary liquid droplets and their return to the solution by means of a series of perforated metal screens. This apparatus is shown diagrammatically in Fig.1 and is described in Bull. Acad. Med. Paris, April and June 1940, and C.R. Soc. Belge de Biologie, 27 April 1940, "Premiere production d'aerosols medicamenteux. Possibilites d'application therapeutique". Conversion of material into an aerosol with 96-97% charged particles was claimed. Size of the aerosol particles may be controlled by varying the concentration of agent in the solution, e.g. a 10% solution of NaCl gave particles of 1.5 μ average diameter, a 0.1% solution - 0.3 μ .

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Uses for vecteurs

Prof. Dautrebande suggested the following uses for "aerosols vecteurs":

1. Offensive C.W.

His method could be used for the dispersion of the usual C.W. agents, e.g. HS. Such aerosols are said to be more toxic than ordinary HS. It has proved possible to kill rats with no visible external lesions, but solely by oedema. Death resulted by exposure of 3-4 hours in an HS aerosol of 2 mg/cubic metre concentration.

WP in the form of a 1% solution in oil had also been dispersed and such aerosols had proved fatal to rats. Prof. Dautrebande could give no indication of the dosages required, but was inclined to believe that the active agent was phosphoric acid (formed by oxidation) rather than WP itself.

This work was described in a preliminary way in "Bases experimentale de la protection contre les gaz de combat", 1 Vol., 380 pages, Ducolot edit. Gembloux 1939 by L. Dautrebande and is undoubtedly known to the Germans.

2. Therapeutic use

For this purpose, a 1.5% solution of the therapeutic agent, e.g. isopropyladrenaline for pulmonary oedema, is made up and used in an apparatus built for medical purposes by Usines Teco, Bois-de-Breux (Liege), one of which we saw. It is understood that about 60 of these are now in use in Belgian hospitals for the treatment of pneumonia, asthma, etc. The aerosol is breathed by the patient from a bag or box. This form of medical treatment is fully described in the series of papers attached (Appendix I). In essence, it is a method for giving a controlled dosage of certain drugs which control expansion or contraction of the lungs, e.g. benzedrine, pilocarpine and especially drugs which, when administered in the normal manner, give rise to undesirable secondary effects.

With this standard apparatus, weighing about 5 pounds, 8 inches long and 4 inches in diameter, about 15-20 cc. solution can be dispersed per hour. Air at 2.5 kilos/sq.cm. is used, 15-17 litres/min. being required.

Prof. Dautrebande expressed his willingness to demonstrate this apparatus in Belgium or England.

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Conclusions

The following points occur to us:

We are uncertain whether or not the therapeutic use of aerosols prepared by Prof. Dautrebande's method is known to the medical profession in Great Britain and the U.S.A. The value of this method of treatment appears to be well founded and deserves further investigation.

As an offensive weapon the practicability of the method seems open to question in view of the extremely low weight efficiency, i.e. large volumes of air required, small amounts of active agent produced, etc. When asked whether he had any specific design for a weapon or bomb in mind, Prof. Dautrebande answered no, but that he would like to work on the problem. It seems doubtful whether he appreciates the practical difficulties involved.

The small particles produced by this method would have a very short life unless the agent has a high boiling point, i.e. it would be necessary to use Q and not HS.

Porton and Edgewood have shown that modern respirators afford complete protection against toxic aerosols of this type.

The effect produced on rats by HS aerosols of this type can be accounted for by the same dosage of vapour.

The WP aerosols produced would be of no value for smoke.

Recommendations

1. The therapeutic use of aerosols prepared by Prof. Dautrebande be brought to the attention of the appropriate medical authorities.
2. No further action seems necessary with regard to the offensive use in C.W. of aerosols prepared by this method.

G. BROUGHTON

E.W. LANFEAR

APPENDIX I

LIST OF DOCUMENTS

Archives Internationales de Pharmacodynamie et de Therapie

Vol 66 No 2

Vol 66 No 3

Vol 66 No 4

Vol 68 No 2

Vol 68 No 3

Vol 68 No 4

Extrait de La Presse Medicale

No 23

No 30

No 33

No 34

No 54

DIAGRAMATIC REPRESENTATION OF AEROSOL GENERATOR USED BY PROF. DAUTREBANDE

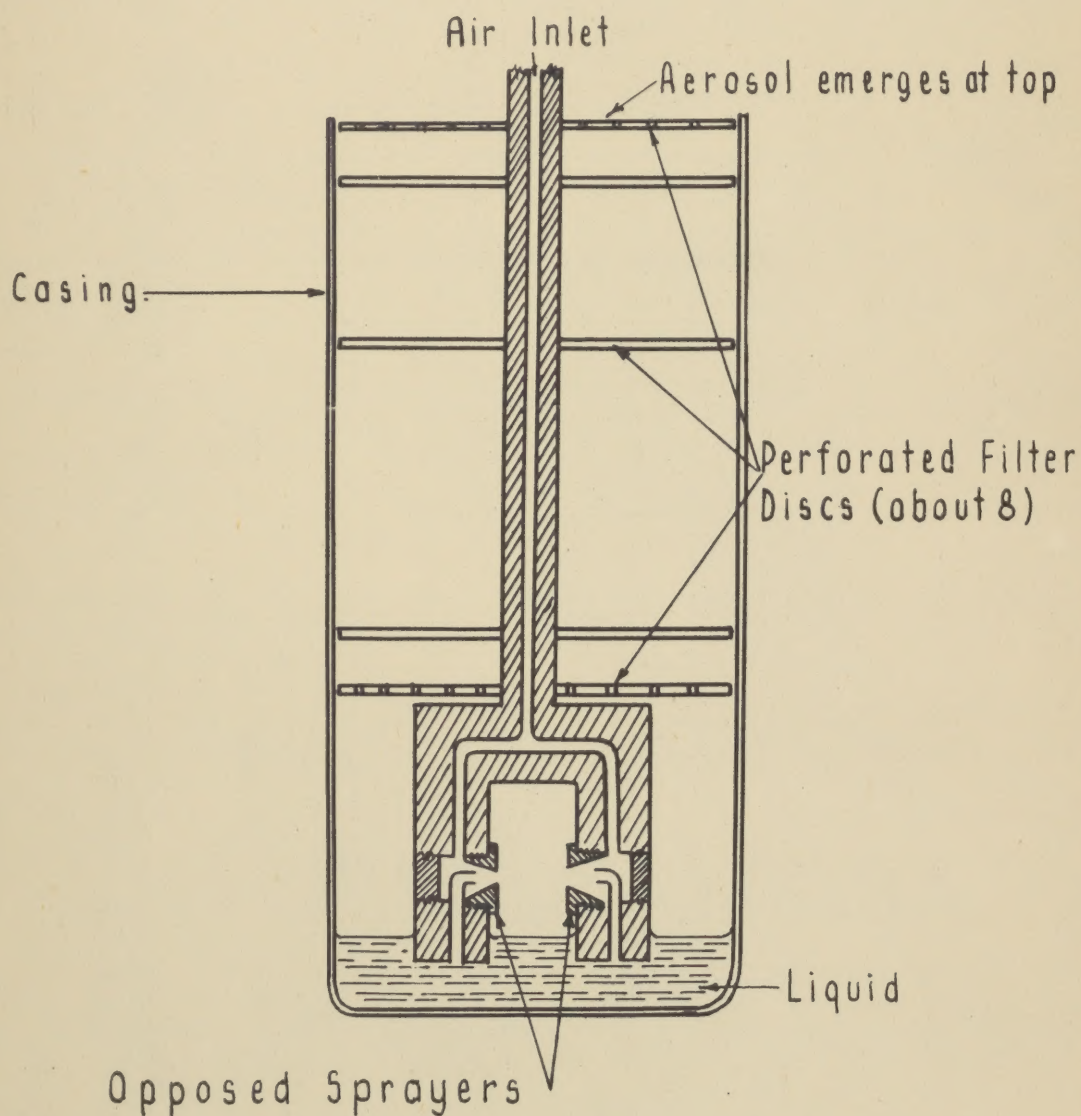


FIGURE 1.

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